Mollusc conservation and the New South Wales *Threatened Species Conservation Act 1995*: the Recovery Program for Mitchell's Rainforest Snail *Thersites mitchellae*

Michael J. Murphy

NSW National Parks and Wildlife Service Northern Directorate Threatened Species Unit
Locked Bag 914 Coffs Harbour NSW 2450 Australia
Email: michael.murphy@npws.nsw.gov.au

ABSTRACT

The New South Wales *Threatened Species Conservation Act 1995* (TSC Act), administered by the NSW National Parks and Wildlife Service, has a primary objective of conserving the state's biological diversity. The listing of threatened fauna under the TSC Act, however, is heavily weighted towards vertebrates, with invertebrates (constituting 99% of the state's fauna diversity) comprising only 4% of the listed threatened fauna species and populations (as at 30 November 2001). Of an estimated 700 land snail species in coastal and near-coastal eastern Australia, only three species have been listed under the TSC Act. This paper discusses the capacity of the NSW National Parks and Wildlife Service and the TSC Act to assist with the conservation of molluscan diversity in New South Wales in general terms and with specific reference to the endangered land snail *Thersites mitchellae* (Mitchell's Rainforest Snail). While difficulties in applying the TSC Act to the conservation of molluscs and other invertebrates do exist, the legislation does provide valuable opportunities for invertebrate conservation.

Key words: molluscs, land snails, conservation, NSW *Threatened Species Conservation Act 1995*, Mitchell's Rainforest Snail, *Thersites mitchellae*, recovery plan.

Introduction

The development of legislation for the protection and conservation of biodiversity in Australia and internationally in recent decades is a reflection of changes in community values and expectations. Current biases in this legislation (towards large vertebrates and vascular plants) reflect the conservation priorities of the broader community, as well as differences in availability of information. This focus on popular or well-known taxonomic groups can be to the detriment of other groups without a high public profile, such as molluscs and the majority of other invertebrate groups, which may be essential to ecosystem functioning. The challenge for wildlife managers and the scientific community is to utilise the opportunities which are available through this legislation to achieve sound conservation outcomes across all taxonomic groups.

Molluscs comprise about 6% of known fauna diversity, about 17% of threatened fauna species worldwide and about 42% of recorded modern fauna extinctions worldwide (IUCN Species Survival Commission 2000). These figures are even more alarming when one considers that less than 5% of mollusc species have been assessed for threatened status, compared to better known groups such as birds and mammals where 100% of species have been assessed, and that many mollusc species are probably disappearing before they are even known (IUCN Species Survival Commission 2000). In Australia up to 25% of mollusc species are potentially vulnerable and many are already under threat (Ponder 2000). Australia has the second highest number of internationally recognised threatened mollusc species in the world (after the United States of America), with molluscs comprising a third of the total of all Australian flora and fauna species considered threatened (IUCN Species Survival Commission 2000). The conservation of molluscan diversity is obviously a serious problem both in Australia and internationally but has received little public attention. This paper discusses the capacity of the New South Wales National Parks and Wildlife Service (NPWS) to assist with the conservation of molluscan diversity in New South Wales in general terms and with specific reference to the endangered land snail *Thersites mitchellae* (Mitchell's Rainforest Snail).

Relevant legislation

The NPWS administers two key pieces of legislation for biodiversity conservation in New South Wales: the *National Parks and Wildlife Act 1974* (NPW Act) and the *Threatened Species Conservation Act 1995* (TSC Act). Under the NPW Act, the NPWS is the authority with responsibility for the care and protection of fauna in New South Wales. The legal definition of 'fauna' under the NPW Act, however, is restricted to mammals, birds, reptiles and amphibians, and therefore excludes molluscs and other invertebrates. Protection of molluscs and other invertebrates under the NPW Act is limited to populations of terrestrial species occurring within national parks and nature reserves. Under the NPW Act it is an offence to harm terrestrial invertebrates in these protected areas.

The TSC Act provides greater potential scope for consideration of molluscs and other invertebrates. The TSC Act enables the listing of threatened species, populations and ecological communities in New South Wales by an independent scientific committee. Listing under the TSC Act provides for the protection and conservation of species, populations and ecological communities across their entire distribution in the state, regardless of land tenure, through measures such as preparation and implementation of recovery plans, consideration in environmental planning matters and licensing controls. The TSC Act allows for the listing of terrestrial invertebrates in addition to terrestrial vertebrates, fungi and terrestrial flora. The TSC Act also includes provision for the listing of key threatening processes, which are responsible for adversely affecting threatened species or causing additional species to become threatened, and for the identification of areas of habitat critical for the survival of threatened species.

With respect to molluscan conservation, the provisions of the NPW Act and TSC Act can be summarised as follows:

- The NPW Act provides statutory protection for populations of all terrestrial molluscs (land snails) occurring within national parks and nature reserves.
- The TSC Act includes provision for the listing and protection of land snails as threatened species, populations or ecological communities throughout NSW, the identification of key threatening processes affecting land snails and the identification of areas of critical habitat for threatened land snails.

The conservation of aquatic (both marine and freshwater) molluscs in New South Wales waters, including sea snails, nudibranchs, freshwater snails, bivalves, chitons and cephalopods, is the responsibility of the New South Wales Fisheries Department under the *Fisheries Management Act 1994* (as amended by the *Fisheries Management Amendment Act 1997*). The *Fisheries Management Act* provides for the management of commercial and recreational utilisation of aquatic molluscs such as oysters, abalone, pipis and squid. The Act also includes provision for the listing and protection of aquatic molluscs as threatened species, populations or ecological communities, the identification of key threatening processes affecting aquatic molluscs, and the identification of critical habitat for threatened aquatic molluscs, in a process similar to that under the TSC Act. One mollusc species has been listed as a threatened species under the *Fisheries Management Act* to date (as at 21 December 2001), the freshwater snail *Notopala sublineata* from the Murray-Darling River system. In addition, one endangered ecological community, the aquatic ecological community of the lower Murray River catchment, has been listed to date. This listed community is described as comprising both vertebrate and invertebrate fauna, including ten mollusc species (four freshwater snails and six bivalves).

The number of recorded extinctions amongst non-marine molluscs worldwide in the last 300 years is higher than any other taxonomic group, exceeding by far the combined bird and mammal extinctions in the same period (IUCN Species Survival Commission 2000). In contrast, the listing of threatened fauna under the TSC Act is heavily weighted towards vertebrates, with invertebrates (constituting 99% of the state's fauna diversity) comprising only 4% of the listed threatened species and populations (as at 30 November 2001). Of an estimated 700 land snail species in coastal and near-coastal eastern Australia (Stanisic 1994), only three species have been listed under the TSC Act to date: *Meridolum corneovirens* from the Cumberland Plain in western Sydney, *Placostylus bivaricosus* from Lord Howe Island and *Thersites mitchellae* from the New South Wales far north coast.

There is a number of difficulties in applying the TSC Act to molluscan conservation. The application of the TSC Act to molluscs is limited to land snails, with the great majority of mollusc taxa covered by the *Fisheries Management Act*. With respect to land snails, as with most other invertebrate groups, there are significant problems posed by the great number of species involved, the paucity of even basic information concerning the taxonomy, ecology and conservation status of most species, and the limited number of professional biologists with relevant expertise to address this information deficit. Basic biological information concerning Australian land snails is lacking for all but a few taxa (Bishop 1981; Ponder 2000), with a large proportion of species never observed in their natural habitat (Smith 1992).

Notwithstanding, the TSC Act does include mechanisms which can provide valuable opportunities for land snail conservation in New South Wales. The Act includes provision for multi-species conservation initiatives through the listing of entire land snail assemblages which are considered to be threatened (as endangered ecological communities), as well as the listing of processes threatening land snails (as key threatening processes). No land snail assemblages have yet been listed as endangered ecological communities under the TSC Act, but the listing of a Hygrocybeae (fungi) community from a bushland remnant at Lane Cove in inner suburban Sydney (NSW Scientific Committee 2000a) illustrates the possibilities available.

A number of key threatening processes relevant to land snails have been listed under the TSC Act to date, including predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island (NSW Scientific Committee 2000b), high frequency fire (NSW Scientific Committee 2000c) and clearing of native vegetation (NSW Scientific Committee 2001). Ponder (1997) listed land clearing and disturbance, frequent fire (including controlled burning) and, at a local scale, predation and habitat degradation by feral animals, as significant threatening processes for Australian molluscs. The introduced Ship Rat has been implicated in the decline or extinction of a number of Lord Howe Island land snails including *Epiglypta howinsulae*, *Gudeoconcha sophiae* and the endangered *Placostylus bivaricosus* (Ponder and Chapman 1999; NSW Scientific Committee 2000b). Approximately 90% of eastern Australian land snail species are restricted to moist closed forests (Stanisic 1994) and frequent fire, including control burning, in these forests can cause significant floristic and structural changes, reducing their suitability as snail habitat. Many species of land snails have very restricted distributions (Ponder 1997; Stanisic 1994, 1997), making them particularly vulnerable to land clearing activities. The preparation and implementation of threat abatement plans is a strategic approach to dealing with these types of broad threats.

With respect to single-species conservation, the TSC Act can perhaps best be used to promote community awareness of mollusc conservation by the listing of individual land snail species as flagship species, which can be promoted in the same context as high profile vertebrate and vascular plant species such as the Koala, Green and Golden Bell Frog and Wollemi Pine. The listing and development of a recovery program for Mitchell's Rainforest Snail, as outlined below, provides an example of how this can be done.

Mitchell's Rainforest Snail

The genus *Thersites* (Family Camaenidae: Subfamily Camaeninae) is a group of large land snails inhabiting rainforests in north-east New South Wales and south-east Queensland (Bishop 1978; Smith 1992). Three species are currently recognised: *Thersites mitchellae* (Cox, 1864) from lowland subtropical rainforest and swamp sclerophyll forest with a rainforest understorey between the Richmond and Tweed Rivers in far north-east New South Wales, *Thersites novaehollandiae* (Gray, 1834) from temperate and subtropical rainforest from the Hunter River in lower north-east New South Wales to the New South Wales/Queensland border and *Thersites richmondiana* (Reeve, 1852) from upland temperate and subtropical rainforest from Wollongbar in far north-east New South Wales to the Conondale Range in south-east Queensland (Bishop 1978; Smith 1992).

Mitchell's Rainforest Snail *Thersites mitchellae* was listed as an endangered species under the TSC Act in March 1997 (NSW Scientific Committee 1997) and its lowland rainforest habitat was listed as an endangered ecological community under the TSC Act in August 1999 (NSW Scientific Committee 1999). The species is also recognised internationally as endangered through listing on the *2000 IUCN Red List of Threatened Species* (IUCN Species Survival Commission 2000), in the category ENC2a.

Mitchell's Rainforest Snail (Fig. 1) has a large shell up to 55 mm wide and 50 mm high, with a strongly elevated spire giving it a triangular profile, and a thickened, reflected lip. The shell is deep reddish chestnut to black in colour with two prominent yellow bands, and has a very fine microsculpture which gives it a satin appearance when held in bright light. The body colour is black with a thin lighter line on the dorsal midline. Live weight is approximately 25 g.

The habitat of Mitchell's Rainforest Snail (Fig. 2) is lowland subtropical rainforest and swamp sclerophyll forest on coastal lowlands, typically on basaltic alluvium. The species is apparently absent from other rainforest types in the area, such as littoral rainforest (Stanisic 1998). This type of correlation with particular rainforest communities is common in many land snail species in eastern Australia (Stanisic 1994). The current range of the species remains approximately the same as its historical distribution, the coastal plain between the Richmond and Tweed Rivers in northern NSW. Coastal north-east New South Wales has experienced major development over the last century, initially for agriculture and now increasingly for urban settlement, and the habitat for Mitchell's Rainforest Snail has been drastically reduced through land clearing. The species' current area of occupancy is estimated to be less than 5 km^2, and much of the surviving habitat is in small, severely fragmented remnants, many of which are still at risk from development. Most of the sites where the species is known to survive are located on slightly elevated ground on the margins of coastal wetlands. This may be an artefact of land clearing patterns or indicate a real microhabitat preference (NPWS 2001a). Key habitat components for Mitchell's Rainforest Snail are a well-developed leaf litter layer (providing food, shelter and breeding sites) and an intact forest canopy (maintaining a moist microclimate and providing a source of leaf litter) (NPWS 2001a).

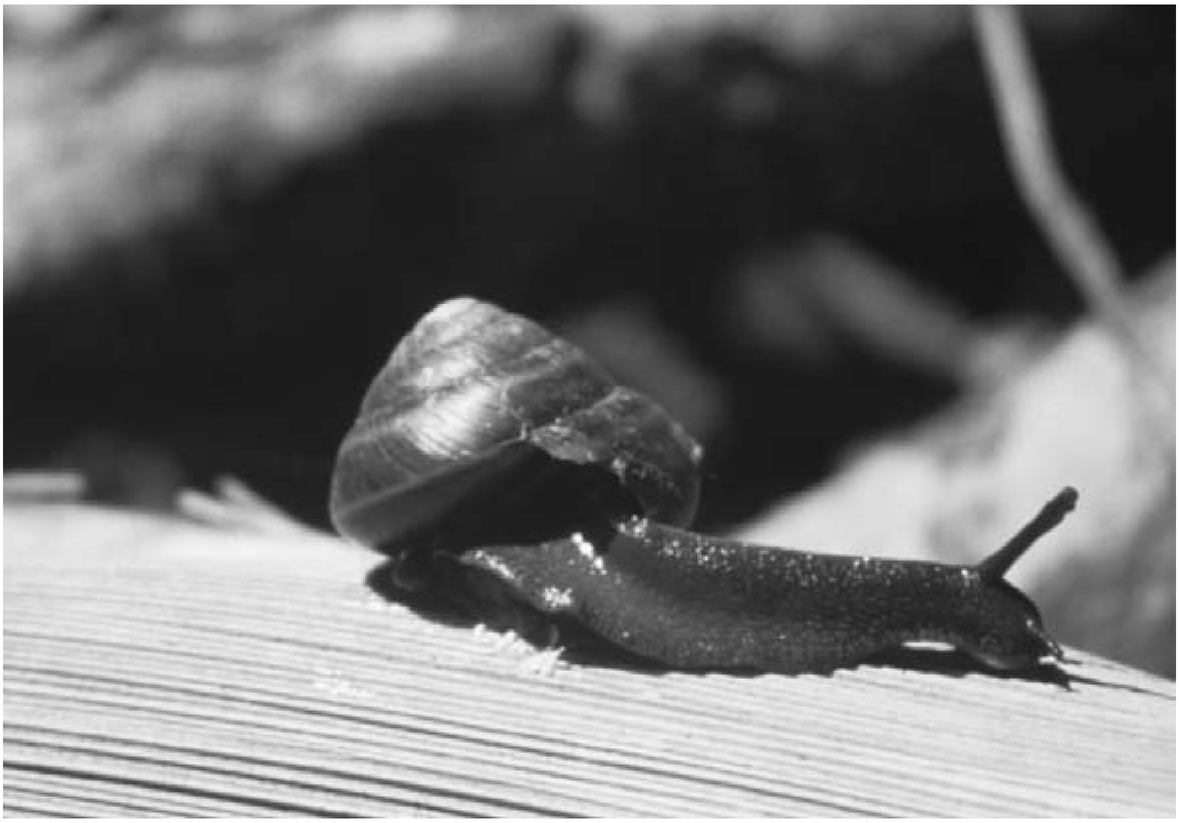


Figure 1. Mitchell's Rainforest Snail *Thersites mitchellae*. Photograph by Michael Murphy

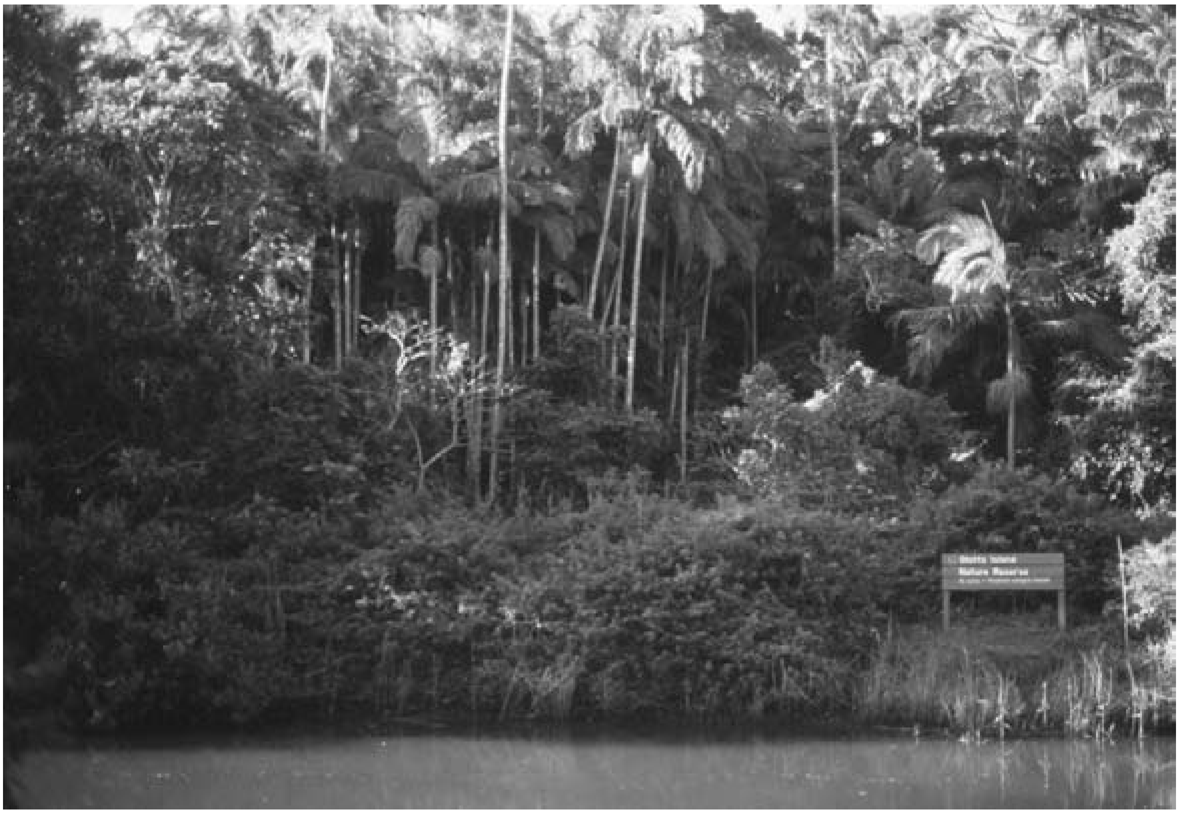


Figure 2. Lowland subtropical rainforest habitat of Mitchell's Rainforest Snail in Stotts Island Nature Reserve. This Reserve was the first area in NSW to be declared as critical habitat under the provisions of the TSC Act. Photograph by Michael Murphy.

Recent records of the species are distributed along the coastal plain between Banora Point in the north and Lennox Head in the south (Fig. 3). The largest known population of Mitchell's Rainforest Snail and largest remaining single area of suitable habitat is in Stotts Island Nature Reserve (Fig. 2) in the Tweed River near Murwillumbah (Stanisic 2000, NPWS 2001a,b). A complex of smaller populations and habitat fragments has also been identified in remnant areas around Cumbebin Wetland at Byron Bay. Mitchell's Rainforest Snail was recorded at a site at Wilsons River near Mullumbimby in 1980 (Stanisic 1999) (Fig. 3). The Wilsons River site (elevation 230 m AHD) is outside the normal range of the species and the other snail species present there, including *Ngairea corticicola, Thersites richmondiana* and *Pedinogyra rotabilis*, are indicative of an upland snail fauna assemblage rather than the lowland snail fauna assemblage usually associated with Mitchell's Rainforest Snail (Stanisic 1999). Mitchell's Rainforest Snail was not found during a targeted search of the Wilsons River site in 1999 and the original record there is suspected to be the result of accidental translocation (Stanisic 1999).

Little information is available on the ecology of Mitchell's Rainforest Snail. Its restriction to rainforest and swamp forest suggests a dependence on high moisture levels, low fire frequency and a well-developed leaf litter layer. Microhabitat data for Mitchell's Rainforest Snail includes records of live animals found by day sheltering under palm fronds on the ground, inside dead palm frond stems, under leaf litter at the base of trees, and under bark in fig *Ficus* trees (Stanisic 1998), and active at night on the surface of leaf litter (Stanisic 2000; Murphy pers. obs.). The related *Thersites novaehollandiae* is active at night, foraging on the rainforest floor and up to six metres high on tree trunks, and is most obviously active on warm, wet nights (Murphy pers. obs.).

Mitchell's Rainforest Snail is herbivorous and is thought to feed on leaf litter, fungus and lichen (Stanisic 2000). Breeding behaviour has only been observed once, with a clutch of 70 small, round, white eggs laid below the surface of leaf litter in November (Murphy pers. obs.) (Fig. 4). Breeding populations of Mitchell's Rainforest Snail can persist in narrow strips of remnant habitat (Stanisic 1998), although the longer-term viability of populations at such sites is uncertain.

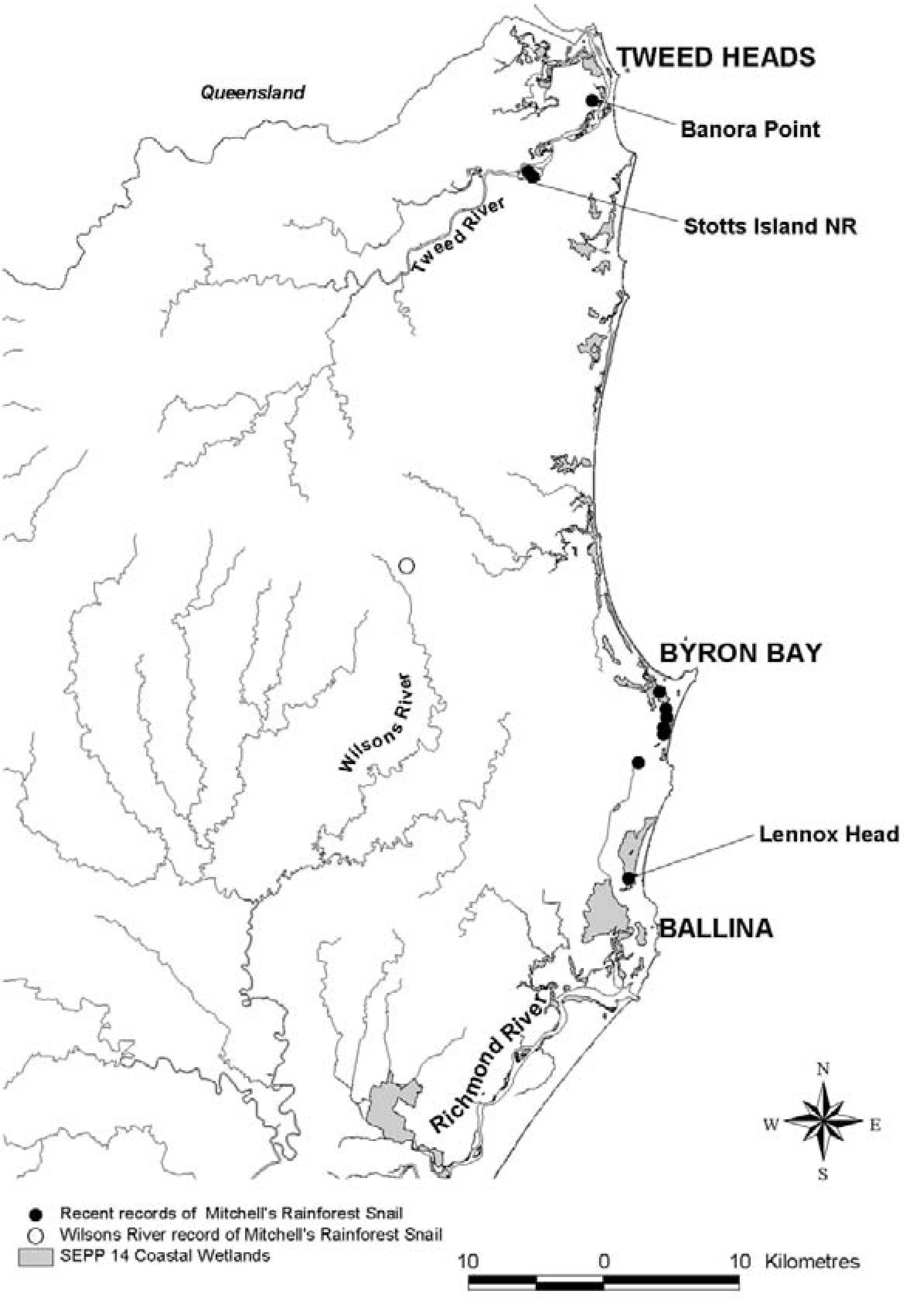

TWEED HEADS
Queensland
Banora Point
Stotts Island NR
Tweed River
Wilsons River
BYRON BAY
Lennox Head
BALLINA
Richmond River
N
W
E
S
● Recent records of Mitchell's Rainforest Snail
○ Wilsons River record of Mitchell's Rainforest Snail
▨ SEPP 14 Coastal Wetlands
10
0
10 Kilometres

Figure 3. Recent records of Mitchell's Rainforest Snail. Source: NSW National Parks and Wildlife Service Atlas of New South Wales Wildlife. SEPP 14 Coastal Wetlands = coastal wetland areas recognised and mapped under State Environmental Planning Policy No. 14 (EPA Act).

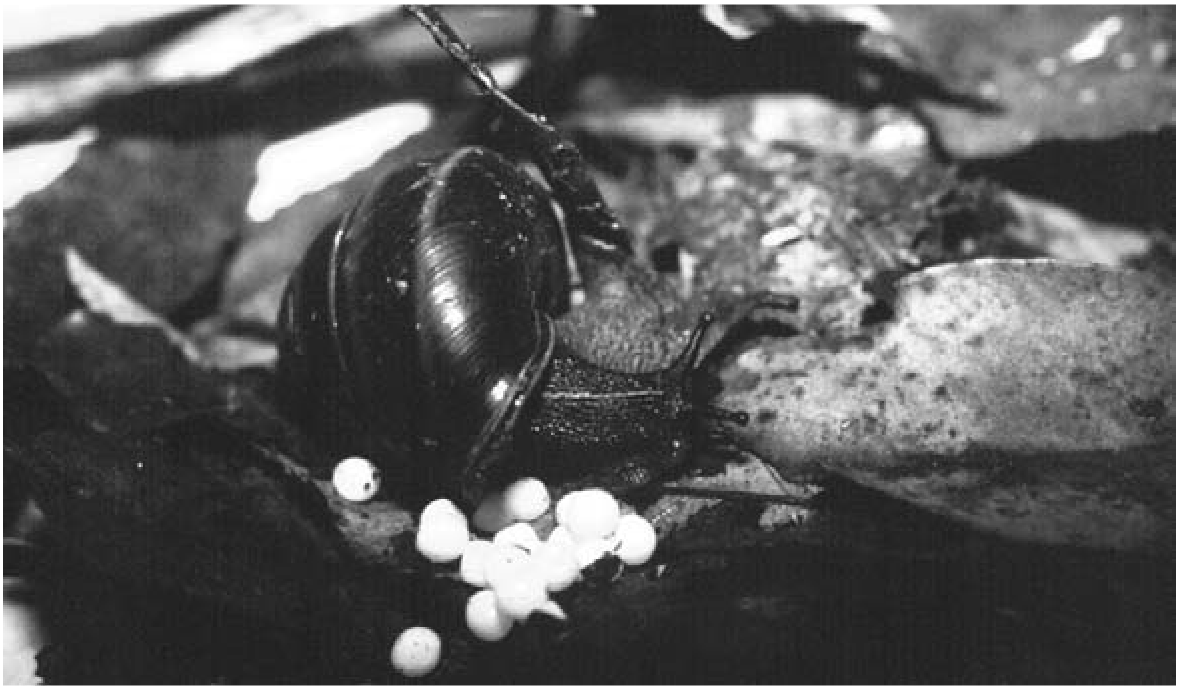


Figure 4. Mitchell's Rainforest Snail with eggs. Photograph by Michael Murphy.

Recovery program for Mitchell's Rainforest Snail

The Mitchell's Rainforest Snail recovery program was developed between 1998 and 2001. A draft recovery plan for the species prepared in accordance with the TSC Act was publicly exhibited in July 2000 (NPWS 2000), and a final recovery plan was approved and released in June 2001 (NPWS 2001a). The recovery plan identifies loss of habitat as the major threat to the species, with fire, exotic weeds and predation by feral animals listed as additional threats. The aim of the recovery plan is to identify and protect the remaining habitat and extant populations of Mitchell's Rainforest Snail and to encourage community involvement in the conservation and recovery of the species. Some of the components of the recovery program are outlined below.

Survey

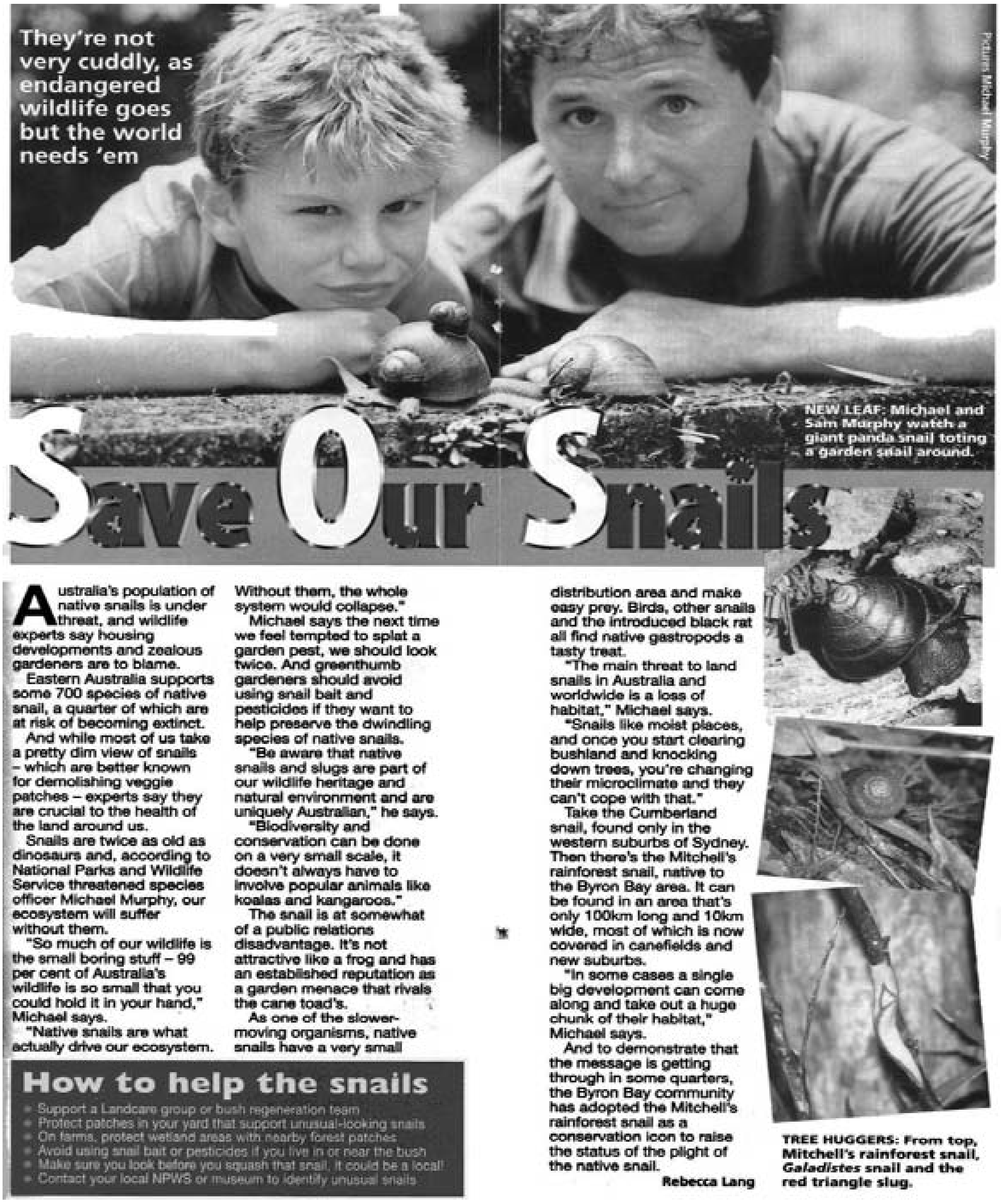
Bishop (1978) noted that Mitchell's Rainforest Snail had not been collected in the field for over 50 years, but noted that a search of the remaining remnants of habitat would be worthwhile. A small number of specimens were collected over the next two decades, and at the time of listing under the TSC Act Mitchell's Rainforest Snail was known from just two sites: Stotts Island Nature Reserve in the Tweed River and Cumbebin Wetland at Byron Bay (NSW Scientific Committee 1997). Dr John Stanisic of the Queensland Museum was engaged by the NPWS in 1998 and 1999 to undertake field surveys to provide additional information on the current status of the species (Stanisic 1998, 1999). This work provided valuable information indicating that Mitchell's Rainforest Snail survived at additional sites across its former range, and was used in the preparation of the recovery plan for the species. The recovery plan proposes further field surveys to locate additional populations as well as long-term monitoring of known populations (NPWS 2001a).

Research

The recovery plan identifies key research areas to provide information necessary for the conservation and recovery of Mitchell's Rainforest Snail (NPWS 2001a). Genetics research examining the level of variation within and between populations of the species will provide important information on the effects of fragmentation and inbreeding and identify key populations for the protection of maximum genetic diversity within the species. Research into the ecology and lifecycle of the species will provide information on movement patterns, dispersal behaviour and ability, microhabitat utilisation, lifespan, fecundity, minimum population size viability and the effects of introduced predators. This information will assist in the management of remaining populations including more robust environmental impact assessment concerning the species.

Community awareness

The NPWS has raised the public profile of Mitchell's Rainforest Snail over recent years through regional, state and national media, including local, metropolitan and national radio interviews, news items on regional commercial television, media stories in local, regional and metropolitan newspapers, and features in popular magazines (Fig. 5). A brochure has also been prepared and distributed by the NPWS to promote community awareness of the status of Mitchell's Rainforest Snail, to encourage community involvement in its conservation and recovery, and to promote the snail as a flagship for broader invertebrate conservation issues. The brochure has been widely distributed through local NPWS offices, local Councils, Landcare groups and local conservation groups. The community awareness program has been successful with a high level of community interest



They're not very cuddly, as endangered wildlife goes but the world needs 'em

Pictures Michael Murphy

NEW LEAF: Michael and Sam Murphy watch a giant panda snail toting a garden snail around.

Save Our Snails

Australia's population of native snails is under threat, and wildlife experts say housing developments and zealous gardeners are to blame.

Eastern Australia supports some 700 species of native snail, a quarter of which are at risk of becoming extinct.

And while most of us take a pretty dim view of snails – which are better known for demolishing veggie patches – experts say they are crucial to the health of the land around us.

Snails are twice as old as dinosaurs and, according to National Parks and Wildlife Service threatened species officer Michael Murphy, our ecosystem will suffer without them.

"So much of our wildlife is the small boring stuff – 99 per cent of Australia's wildlife is so small that you could hold it in your hand," Michael says.

"Native snails are what actually drive our ecosystem. Without them, the whole system would collapse."

Michael says the next time we feel tempted to splat a garden pest, we should look twice. And greenthumb gardeners should avoid using snail bait and pesticides if they want to help preserve the dwindling species of native snails.

"Be aware that native snails and slugs are part of our wildlife heritage and natural environment and are uniquely Australian," he says.

"Biodiversity and conservation can be done on a very small scale, it doesn't always have to involve popular animals like koalas and kangaroos."

The snail is at somewhat of a public relations disadvantage. It's not attractive like a frog and has an established reputation as a garden menace that rivals the cane toad's.

As one of the slower-moving organisms, native snails have a very small distribution area and make easy prey. Birds, other snails and the introduced black rat all find native gastropods a tasty treat.

"The main threat to land snails in Australia and worldwide is a loss of habitat," Michael says.

"Snails like moist places, and once you start clearing bushland and knocking down trees, you're changing their microclimate and they can't cope with that."

Take the Cumberland snail, found only in the western suburbs of Sydney. Then there's the Mitchell's rainforest snail, native to the Byron Bay area. It can be found in an area that's only 100km long and 10km wide, most of which is now covered in canefields and new suburbs.

"In some cases a single big development can come along and take out a huge chunk of their habitat," Michael says.

And to demonstrate that the message is getting through in some quarters, the Byron Bay community has adopted the Mitchell's rainforest snail as a conservation icon to raise the status of the plight of the native snail.

Rebecca Lang

How to help the snails

- Support a Landcare group or bush regeneration team
- Protect patches in your yard that support unusual-looking snails
- On farms, protect wetland areas with nearby forest patches
- Avoid using snail bait or pesticides if you live in or near the bush
- Make sure you look before you squash that snail, it could be a local!
- Contact your local NPWS or museum to identify unusual snails

TREE HUGGERS: From top, Mitchell's rainforest snail, *Galadistes* snail and the red triangle slug.

Figure 5. A major component of the Mitchell's Rainforest Snail recovery program has been promoting community awareness of the species and broader invertebrate conservation issues through popular media. Article reproduced from Aussie POST, January 20, 2001.

and a number of new sites for Mitchell's Rainforest Snail discovered by community members. Broader conservation issues promoted through the Mitchell's Rainforest Snail community awareness program have included awareness of the diversity and value of native invertebrates and the importance of small-scale local habitat protection.

The Foundation for National Parks and Wildlife (a private fund-raising organisation) included Mitchell's Rainforest Snail as one of the six species featured in its *2000 Threatened Species Appeal*, a first for a land snail species. The appeal has assisted in raising the profile of Mitchell's Rainforest Snail and invertebrate conservation in general. Money raised in the appeal is being used by the NPWS and Department of Education and Training to fund preparation of educational material concerning Mitchell's Rainforest Snail and land snail conservation to be used in primary schools in the Tweed, Byron Bay and Ballina areas.

Development Control

A major strategy by which the TSC Act aims to achieve its conservation objectives is the incorporation of threatened species consideration into the NSW planning and approval process. The *Environmental Planning and Assessment Act 1979* (EPA Act) is the major piece of legislation controlling land use planning and development in NSW. The TSC Act introduced a number of amendments to the EPA Act, whereby approval authorities (local Councils and government authorities) must now consider the potential impacts of proposals on threatened species and their habitats, and seek the concurrence of the Director-General of National Parks and Wildlife where such impacts are likely to be significant or where critical habitat for threatened species will be affected.

Mitchell's Rainforest Snail has been a consideration in a number of recent development proposals, particularly in the Cumbebin Wetland/Suffolk Park area of Byron Shire, which is a significant area for the species. The occurrence of Mitchell's Rainforest Snail on development sites indicates that the loss of habitat continues to be a significant threat to the species. However, through its listing under the TSC Act the species now has a 'voice' in the environmental planning and approval process. Accordingly, development proposals are required to be designed to minimise impacts on the species and retain significant areas of habitat. The recovery plan recommends that all remaining areas of habitat or potential habitat for Mitchell's Rainforest Snail be protected from clearing or development through the relevant local environmental plans and regional vegetation management plans (NPWS 2001a). To assist local Councils with strategic identification of habitat areas the NPWS proposes to produce maps of predicted habitat for Mitchell's Rainforest Snail based on geographic information system analysis of the occurrence of lowland floodplain rainforest and swamp forest remnants, coastal wetlands, basaltic-derived alluvium and recent and historical records of the species (NPWS 2001a).

The NPWS has also produced environmental impact assessment guidelines relating to Mitchell's Rainforest Snail, with the assistance of expert malacologists familiar with the species (NPWS 2001a). These guidelines are designed to assist those required to prepare or review assessments of likely impacts on Mitchell's Rainforest Snail, and include information concerning field survey methods, habitat assessment, and consideration of significance of likely impacts on the species (per section 5A EPA Act). The guidelines will assist in the preparation of Environmental Impact Assessment reports, Statements of Environmental Effects and Species Impact Statements by proponents of developments or activities pursuant to the EPA Act, and the review of environmental reports by consent and determining authorities.

Critical Habitat

The status and occurrence of Mitchell's Rainforest Snail and its habitat in Stotts Island Nature Reserve was examined in a joint project by the NPWS and Queensland Museum in December 1999 (Stanisic 2000). Stotts Island (Fig. 2) is the last major remnant of subtropical floodplain rainforest in NSW (NPWS 2001b, c), and supports the largest known population of Mitchell's Rainforest Snail and largest remaining area of suitable habitat (Stanisic 2000; NPWS 2001a, b). Unlike many of the recent sites where Mitchell's Rainforest Snail has been recorded, which are small in area and considered marginal, Stotts Island has approximately 120 ha of lowland subtropical rainforest present (Floyd 1990) and an estimated Mitchell's Rainforest Snail population of several hundred snails (Stanisic 2000). The Plan of Management recently prepared for Stotts Island includes prominent consideration of the significance of the site for Mitchell's Rainforest Snail (NPWS 2001c). The New South Wales government declared the entire Island as critical habitat for Mitchell's Rainforest Snail under the provisions of the TSC Act in November 2001 (NPWS 2001b). This is the first critical habitat declaration for any species in NSW and the only current critical habitat declaration in Australia.

Declaration as critical habitat gives Stotts Island Nature Reserve the highest protection possible under NSW legislation. The declaration will assist in raising community awareness of the status of Mitchell's Rainforest Snail and the significance of Stotts Island for its conservation, as well as raising the community profile of mollusc conservation in general. This critical habitat declaration will also greatly assist implementation of the TSC Act's critical habitat provisions across a range of endangered species and land tenures by increasing community awareness of these provisions and establishing an administrative process to be followed.

The recovery plan also proposes assessment of additional areas of habitat for identification as critical habitat under the TSC Act (NPWS 2001a). This assessment will in part be based on the results of predictive habitat mapping and further field survey as outlined above.

Guidelines for collection

Listing of an invertebrate under the TSC Act triggers a need for licensing of certain actions which may harm the species or damage its habitat. Under the current legislation, such actions can include professional and amateur scientific research involving threatened invertebrates. This is because, in contrast to research involving threatened vertebrates, invertebrate research cannot be covered by scientific licences issued under the NPW Act (a result of the restricted definition of 'fauna' under the NPW Act). The prospect of licensing of invertebrate research under the TSC Act has generated some concern in the scientific community (Greenslade 1999; Gunning 1999).

Guidelines for research involving the collection of threatened land snails have been developed by the NPWS in consultation with professional malacologists (NPWS 2001a). These guidelines have been designed to facilitate the timely licensing of land snail research licence applications under the TSC Act, while ensuring that licensed activities will not further threaten the survival of threatened land snail species or populations of these species. Researchers from a number of institutions have operated under licences (TSC Act section 95 certificates) incorporating these guidelines.

Listing under Commonwealth legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) lists species and ecological communities considered threatened at the national level. As with the TSC Act and IUCN Red List, listing of fauna under the EPBC Act is biased towards vertebrates, with only eight invertebrate species listed as threatened species under the EPBC Act to date (as at 5 February 2001), this comprising only 3% of the total threatened fauna species listed. No land snail species or other molluscs are currently listed. The NPWS has nominated Mitchell's Rainforest Snail for listing as an endangered species under the EPBC Act. Listing of Mitchell's Rainforest Snail would assist in raising awareness of the status of this species and land snail fauna in general at the national level. In addition, under the EPBC Act, proposed actions likely to have a significant impact on listed species and communities require the approval of the Commonwealth Minister for the Environment.

Conclusion

The Mitchell's Rainforest Snail recovery program demonstrates that the TSC Act can make a worthwhile contribution to molluscan biodiversity conservation in New South Wales through encouraging scientific research, increasing community awareness, promoting flagship species, identifying critical areas for protection and incorporating consideration of invertebrates into the planning process. Additional opportunities yet to be utilised or fully utilised include the provision for listing land snail assemblages as endangered ecological communities and listing processes affecting land snails as key threatening processes. While difficulties in applying the TSC Act to the conservation of molluscs and other invertebrates do exist, the scientific community and the broader community should recognise and fully utilise the opportunities presented by this legislation.

Acknowledgements

This paper was originally presented at the Malacological Society of Australasia's *Molluscs 2000 Symposium* in Sydney, Australia in December 2000. Andrew McIntyre, Dan Lunney and two anonymous referees provided comments on an earlier draft of this paper. The author also acknowledges the significant contribution of John Stanisic (Queensland Museum) towards the recovery of Mitchell's Rainforest Snail. Figure 5 was reproduced courtesy of Rebecca Lang and the Aussie POST magazine. Copies of the recovery plan and critical habitat declaration for Mitchell's Rainforest Snail can be found at the NSW National Parks and Wildlife Service website **www.npws.nsw.gov.au**.

References

Bishop, M. J. 1978. A revision of the genus *Thersites* Pfieffer (Pulmonata: Camaenidae). *J. Malac. Soc. Aust.* **4(1-2)**: 9-21.

Bishop, M. J. 1981. The biogeography and evolution of Australian land snails. Chapter 32 pp. 925-54 in *Ecological Biogeography of Australia*. A. Keast (ed.). Dr W. Junk Publishers, The Hague.

Floyd, A. 1990. *Australian Rainforests in New South Wales. Volume II*. Surrey Beatty & Sons Pty Ltd, Chipping Norton, NSW.

Greenslade, P. 1999. What entomologists think about listing species for protection: a survey of butterfly specialists in Australia. Pp. 345-49 in *The Other 99%. The Conservation and Biodiversity of Invertebrates* edited by Winston Ponder and Daniel Lunney 1999. Transactions of the Royal Zoological Society of New South Wales, Mosman NSW.

Gunning, R. V. 1999. New South Wales Threatened Species Conservation Act 1995; the invertebrate experience so far. Pp. 350-53 in *The Other 99%. The Conservation and Biodiversity of Invertebrates* edited by Winston Ponder and Daniel Lunney 1999. Transactions of the Royal Zoological Society of New South Wales, Mosman NSW.

International Union for the Conservation of Nature Species Survival Commission. 2000. *2000 IUCN Red List of Threatened Species*. IUCN Species Survival Commission, Gland, Switzerland.

National Parks and Wildlife Service. 2000. *Mitchell's Rainforest Snail* Thersites mitchellae *(Cox, 1864) Draft Recovery Plan*. NSW National Parks and Wildlife Service: Hurstville, NSW.

National Parks and Wildlife Service. 2001a. *Mitchell's Rainforest Snail* Thersites mitchellae *(Cox, 1864) Recovery Plan*. NSW National Parks and Wildlife Service: Hurstville, NSW.

National Parks and Wildlife Service. 2001b. Declaration of critical habitat for Mitchell's Rainforest Snail (*Thersites mitchellae*) in Stotts Island Nature Reserve. NSW National Parks and Wildlife Service: Hurstville, NSW.

National Parks and Wildlife Service. 2001c. *Stotts Island Nature Reserve Plan of Management*. NSW National Parks and Wildlife Service: Hurstville, NSW.

NSW Scientific Committee. 1997. Final determination to list *Thersites mitchellae* as an endangered species on Schedule 1, Part 1 of the *Threatened Species Conservation Act* 1995.

NSW Scientific Committee. 1999. Final determination to list Lowland Rainforest on Floodplain in the NSW North Coast bioregion as an endangered ecological community on Schedule 1, Part 3 of the *Threatened Species Conservation Act* 1995.

NSW Scientific Committee. 2000a. Final determination to list the Hygrocybeae Community of Lane Cove Bushland Park as an endangered ecological community on Schedule 1, Part 3 of the *Threatened Species Conservation Act* 1995.

NSW Scientific Committee. 2000b. Final determination to list predation from the Ship Rat *Rattus rattus* on Lord Howe Island as a key threatening process on Schedule 3 of the *Threatened Species Conservation Act* 1995.

NSW Scientific Committee. 2000c. Final determination to list high frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition as a key threatening process on Schedule 3 of the *Threatened Species Conservation Act* 1995.

NSW Scientific Committee. 2001. Final determination to list clearing of native vegetation as a key threatening process on Schedule 3 of the *Threatened Species Conservation Act* 1995.

Ponder, W. F. 1997. Conservation status, threats and habitat requirements of Australian terrestrial and freshwater Mollusca. *Memoirs of the Museum of Victoria* **56(2)**: 421-430.

Ponder, W. F. 2000. Understanding molluscan diversity in our region – past progress and future directions. *Molluscs 2000 Symposium Abstracts*. Pp: 69-71. Malacological Society of Australasia. Sydney, Australia.

Ponder, W. F and Chapman, R. 1999. Survey of the Land Snail *Placostylus bivaricosus* on Lord Howe Island. Unpublished report to the NSW National Parks and Wildlife Service.

Smith, B. J. 1992. *Non-marine Mollusca*. In *Zoological Catalogue of Australia*. Volume 8. W. W. K. Houston (ed.). Australian Government Publishing Service, Canberra. 405 pp.

Stanisic, J. 1994. The distribution and patterns of species diversity of land snails in eastern Australia. *Memoirs of the Queensland Museum* **36(1)**: 207-214.

Stanisic, J. 1997. An area of exceptional land snail diversity: the Macleay valley, north-eastern New South Wales. *Memoirs of the Museum of Victoria* **56(2)**: 441-448.

Stanisic, J. 1998. Survey for Land Snail *Thersites mitchellae* in Northern New South Wales. Unpublished report prepared for NSW National Parks and Wildlife Service.

Stanisic, J. 1999. Survey for Land Snail *Thersites mitchellae* in Northern New South Wales II. Investigation of Wilsons Creek locality. Unpublished report prepared for NSW National Parks and Wildlife Service.

Stanisic, J. 2000. Survey for Land Snail *Thersites mitchellae* in Northern New South Wales III. Investigation of Stotts Island locality. Unpublished report prepared for NSW National Parks and Wildlife Service.